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Littoral Combat Ship Wargame Phase 1 (Sustainment) Report of Findings



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Prelude

October 13, 2016: The commanding officers of the four Littoral Combat Ships operating out of forward operating stations sit at a table celebrating the Navy's 241st birthday. They are telling sea stories of their history making deployments. The two columns below offer alternative potential futures of what that conversation might sound like.

The CO of INDEPENDENCE spoke first, "We were supposed to complete our 96 hour mission package exchange two days ago, but the ordnance is still in CONUS awaiting diplomatic clearance."

"Our last crew swap was difficult. The off hull crew's large group travel got fouled up and they ended up staying an extra three days. The Sling Inn was full and we had to put the whole crew out in town on \$463 a day per diem", grumbled the FREEDOM's CO.

MILWAUKEE's CO chimed in, "My crew is exhausted. Our AT/FP mitigation and augmentation requests got turned down during our last port call. Everyone had to stand double watches to cover the AT/FP requirements. I even had to have the XO out on the pier keeping an eye on the contracted security personnel during the reception we had onboard."

The JACKSON CO brooded quietly. He had not had any of the difficulties his peers had experienced, but he still was disquieted, for he was suffering a malady common to them all, a complete lack of understanding of commander's intent, C2 relationships, and what his ship's role was in the scheme of maneuver.

The CO of INDEPENDENCE spoke first, "We just completed our mission package exchange. We planned ahead and pre-staged everything at Guam so we were able to execute the entire swap, including ordnance, on time and within budget."

"Our last crew swap was a breeze even though the off hull crews' large group travel got fouled up, but the overflow annex that got built onto the Sling Inn back in 2015 was able to accommodate us for the two days it took to get that SNAFU fixed." boasted the FREEDOM's CO.

MILWAUKEE's CO chimed in. "Our last port call was a huge success. The LCS specific AT/FP mitigations codified back in 2012 made it possible for us to complete six COMREL events and get everyone some much needed liberty."

The JACKSON CO beamed out loud. "I just completed CARAT Indonesia. Our clearly defined OPCON/ADCON relationships and LCSRON(fwd)'s support made execution effortless.

The above conversations, while fictional, are potential futures for forward deployed Littoral Combat Ships in 2016. The actual words of the commanding officers are dependent upon resolution of existing sustainment and logistical issues. Many of these issues are presented as findings in this report.

This report was prepared by U.S. Fleet Forces Command and Navy Warfare Development Command

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Executive Summary

Overview:

This report presents the results of the Littoral Combat Ship (LCS) Sustainment Wargame, conducted 23-26 January 2012 in Suffolk, VA. In November 2011, Commander, U.S. Fleet Forces Command (CUSFFC) and Commander, U.S. Pacific Fleet (CPF) recommended and CNO endorsed conducting this wargame to enable planning for successful execution of LCS operations from a future Forward Operating Site (FOS). CUSFFC and CPF provided initiating guidance for Phase I of the wargame to "...identify key sustainment and logistics issues and risks, and develop mitigations in order to operate LCS in the Pacific Fleet AOR." The problem statement for LCS Wargame Phase I was as follows: *Navy Component Commanders and Force Providers require a comprehensive understanding of planning factors associated with sustainment and logistic support of LCS seaframes and mission packages.*

Planning and execution of LCS Wargame Phase I was directed by Naval Warfare Development Command and the Naval War College, in support to U.S. Fleet Forces Command as Wargame Sponsor. Participants included subject matter experts from U.S. Fleet Forces Command, Pacific Fleet, Third Fleet, Fourth Fleet, Sixth Fleet, Navy Surface Forces Pacific, PEO-LCS, Lockheed Martin, General Dynamics, and other organizations with equities in LCS logistics and sustainment; 18 organizations in all. Three potential FOS sites were considered in this wargame—Sasebo, Guam, and Singapore – representing varying degrees of robust, moderate, and austere levels of capability to sustain USN surface ships.

The wargame included scenario play by three separate teams of LCS and mission package subject-matter experts selected from a cross-section of commands and organizations. A total of 23 scenario events were injected during 6 game "turns" over four days, with heavy emphasis placed on understanding implications of mission package exchanges, sea-frame manpower constraints, and FOS supportability of LCS maintenance and sustainment. Wargame Terms of Reference were based on assumptions and planning guidance contained within the LCS Platform Wholeness Concept of Operations (CONOPS) and other key LCS and Mission Package reference documents.

Findings and Recommendations: LCS Wargame Phase I produced seven major classifications of findings and twenty specific recommendations, based on scenario play results, participant views, and post-game additional interviews and analysis. The validity of the results is considered to be high based upon the diversity, expertise and relevancy of the participants. The following summarizes Findings and Recommendations:

Finding: MP Exchanges – An in-theater LCS Mission Package (MP) exchange requires deliberate planning, coordination, and longer lead time than implied by reference documents.

Recommendations:

- Update the LCS Platform Wholeness CONOPS with a refined sequence of events of Mission Module (MM), aviation components, crew, ordnance, equipment and supplies, and retrograde. Sequencing will include the C2, transportation, storage/staging, and pier equipment requirements for MM and aviation components of the MP. Lead: CNSP
- Update the LCS Wholeness CONOPS to accurately reflect the in-theater training / certification requirements, logistics timeline, and transportation costs associated with Mission Package Exchanges. Lead: CNSP

- Establish mechanism and update directives/documentation to incorporate LCS Mission Modules and respective aviation packages (as distinguishable assets separate from LCS sea-frame) into the GFM planning and force allocation decision/approval process. Lead: USFF N3GFM - CPF N3
- Establish an effective off-hull mission package upkeep/maintenance, rotation and apportionment plan to support 4 LCS in WESTPAC FOS, focused on Singapore. Lead: PEO LCS

Finding: LCS Squadron (LCSRON) - Distance Support (DS) - The Littoral Combat Ship Squadron (LCSRON) is the critical node for distance support of LCS maintenance, manning, training, and sustainment.

Recommendations:

- Develop an LCSRON and shore support system COOP plan to mitigate loss of LCSRON capability, loss of DS communications, and provide for DS data redundancy and maximize connectivity for continued support of squadron ship. Lead: CNSP / LCSRON-1 assist
- Continue to refine manning requirement and resource as appropriate LCS Support Team (LST), Maintenance Support Team (MST) and LCSRON FOS Detachment within the FYDP and beyond. Lead: OPNAV N1 w/ CNSP support

Finding: Product Support Plan (PSP) - PSP on-site maintenance is highly dependent on workforce skills and capacity to be able to deliver to the FOS. Title 10 interpretation restricts labor to U.S. Government and contractors for non-FDNF ships during planned maintenance availabilities.

Recommendations:

- Define Title 10 guidelines for periodic scheduled maintenance of a non-FDNF ship. Lead: NAVSEA
- Seek waiver of Title 10 restrictions, if necessary, to optimize use of host nation personnel for preventive and facilities maintenance. Lead: NAVSEA
- Conduct business case analysis to assess cost and effectiveness of maintenance strategies involving Gov't/Contractor hybrids of permanent on site, Fly-away, and/or HN maintenance teams. Lead: PEO LCS

Finding: Anti-terrorism/Force Protection (AT/FP) - LCS crews (to include MP personnel) can self-sustain AT/FP measures at FPCON ALPHA for an unlimited period of time. At higher FPCON, AT/FP capability is severely limited without force augmentation or other FPCON mitigations.

Recommendations:

- Review and update as required the following documents, to account for LCS FPCON limitations/mitigations: (a) Navy Wide Arming Matrix, (b) FPCON measures delineated in DoDI 200.16 to address applicability to LCS manning constraint, (c) Manpower mitigations in the Navy Wide OPTASK AFTP targeted for release 31 MAY 2012. Lead: USFF N3AT
- Review status of and prioritize for update (or new start) Personal Security Vulnerabilities Assessments (PSVA) on all potential WESTPAC ports of call for LCS. Identify ports LCS will visit that have never or very infrequently been visited by USN Ships. Coordinate site surveys, husbanding contracts, and points of contact with port and HN government personnel, as appropriate. Lead: CPF

Finding: FOS / ROS Shore Support – LCS FOS sites and potential Remote Operating Sites (ROS) / ports of call require additional port-specific research and planning for shore facilities/equipment requirements and other support capabilities needed for sea-frame, aviation, and mission package sustainment.

Recommendations:

- Identify and prioritize infrastructure requirements for likely LCS ports of call in PACFLT AO. Lead: CPF
- Establish FOS shore infrastructure requirements. Engage host-nation on prioritization of LCS support requirements and possible cost sharing arrangements. Identify and resource gaps and seams not supported by HN. Lead: CPF w/CNIC support (Requirements), OPNAV N4(Resourcing), OPNAV N3/5 (HN agreements)
- Submit to the National Geospatial-Intelligence Agency (NGA) a prioritized list of DNC production requirements for ports in the PACFLT AO that will be used by LCS. Lead: CPF w/ OPNAV N2/6 support.

Finding: Ordnance and Hazardous Materials (HAZMAT) - Restrictions on ordnance and hazardous materials (HAZMAT) movement / management in Singapore and Japan have potential to impact timely maintenance / logistics and effective operations from selected FOS.

Recommendations:

- Identify likely ports LCS will use for mission package exchanges and negotiate agreements to support ordnance and HAZMAT management. Lead: CPF
- Create an LCS Ordnance Transportation Logistics CONOPS to address the process, sequencing, transportation, onload / offload of ordnance aboard LCS seaframe in CONUS and OCONUS. Lead: PEO LCS w/USFF support
- Develop a LCS HAZMAT Management Instruction to support seaframe and mission package maintenance, HAZMAT storage, offload / onload, and transportation to support FOS. Lead: NAVSUP w/LCSRON-1 support

Finding: Maintenance Strategy - Traditional Planned Maintenance System (PMS) approach is not feasible for forward-deployed LCS due to limitations in ships' force capacity and skills and in capacity ashore at the FOS as compared to INCONUS homeports. Alternative strategy required to include effective utilization/integration of LCS Product Support Plan, Reliability Engineering/Condition-Based Maintenance (RE/CBM) monitoring/forecasting, and establishing effective operations + maintenance battle rhythm.

Recommendations:

- Evaluate Reliability Engineering Model for potential elimination and /or reduction in preventive maintenance requirements, to include "replace when fail" approach as appropriate. Lead: PEO LCS
- Conduct bottom-up review of PMS deck for LCS 1 and provide recommendations on adjustments, based on Reliability Engineering approach. Lead: PEO LCS
- Conduct CBA of sensors/software installation plan aboard LCS 1 to determine potential LCS program-wide applicability, manhour impacts, and cost savings. Implement POAM for LCS-Class RE installation as appropriate. Lead: PEO LCS

Littoral Combat Ship (LCS) Sustainment Wargame - Phase 1 Report of Findings

1. Overview

In November 2011, Commander, U.S. Fleet Forces Command (CUSFFC) and Commander, U.S. Pacific Fleet (CPF) recommended and CNO endorsed conducting a wargame to enable planning for successful execution of LCS operations from a future Forward Operating Site (FOS) in the Western Pacific. CUSFFC and CPF provided initiating guidance for the Phase I of the wargame to "...identify key sustainment and logistics issues and risks, and develop mitigations in order to operate LCS in the Pacific Fleet AOR." The problem statement for this wargame was as follows: *Navy Component Commanders and Force Providers require a comprehensive understanding of planning factors associated with sustainment and logistic support of LCS seaframes and mission packages.* Wargame Terms of Reference were based principally on assumptions and planning guidance contained within the LCS Platform Wholeness Concept of Operations (CONOPS) and other key LCS and Mission Package directives. LCS Wargame Phase I (Sustainment) was executed from 23-26 January 2012 in Suffolk, VA. Analysis and post wargame interviews continued into February 2012. A second operationally focused wargame is planned for June 2012 (Phase II).

The wargame identified sustainment issues, associated risks, mitigation actions, and information that enables understanding of LCS planning factors. These issues are addressed in the findings section of this report. Seven major findings and 20 recommendations are presented. A consolidated list of these findings is presented in Table 3-1 on page 8. Additional findings are contained in Annex B of this report.

As a follow-on effort, a series of four issue specific excursions will be conducted that build upon the results of the first wargame. These excursions will focus on solution development for 1) mission module exchanges, 2) near term deployment planning, 3) LCS command & control (C2) relationships and fleet and combatant commanders' intent for operational and tactical employment of LCS, and 4) seaframe rotation variations. These excursions shall be conducted in the March through May timeframe and will produce stand alone deliverables while informing the build of the operations wargame.

1.1. LCS Sustainment Wargame Problem Statement and Objectives.

The following problem statement, objective, and sub-objectives were derived from the initial guidance:

Problem statement: Naval Component Commanders (NCC) and force providers require a comprehensive understanding of planning factors associated with sustainment and logistic support of LCS seaframes and MPs.

Objective: To identify key sustainment and logistics resourcing issues and mitigations associated with operating LCS in the Pacific Fleet AOR in the context of the LCS Platform Wholeness CONOPS

Sub-objectives:

- Evaluate capabilities and limitations of a forward operating site (FOS) in basing/operating LCS seaframes and associated MPs
- Assess maintenance provider (labor) support options of LCS seaframe and associated MPs in forward deployed locations
- Assess supply (parts)/sustainment support options of LCS seaframe and associated MP in forward deployed locations
- Assess the impacts on LCS seaframe and associated MPs when situational deviations / disruptions are imposed in the steady-state sustainment environment

The objective and sub-objectives defined analytical requirements and framed wargame design.

1.2. Methodology

The wargame was sponsored by CUSFFC and CPF to identify key logistics and sustainment issues of LCS in the PACOM AOR. USFF N8 organized a team comprised of members of USFF, CPF, CNSP, the Naval War College, Navy Warfare Development Command, and supporting personnel from Lockheed Martin's Center for Innovation and General Dynamics to conduct wargame planning and preparation. It was recognized that executing a wargame alone would not adequately uncover and offer resolution of encompassed issues. A two-pronged approach was taken: execute both a wargame and a parallel modified study effort to address specific issues/excursions. Additionally a third data generating source, subject matter expert (SME) breakout sessions, was instituted and executed concurrently with the wargame.

2. LCS Sustainment Wargame Design and Execution

The LCS sustainment wargame was designed as a scenario based seminar wargame. The wargame consisted of six moves. Three player teams stepped through the moves and addressed sustainment and logistical problems as they were presented. Each team consisted of 12 people with skills identified in the LCS CONOPS and a mix of personnel from relevant operational, sustainment, and resourcing organizations. This approach provided different perspectives and "expert" looks at multiple sustainment and logistic problems. In Figure 2-1 this process of moving from one turn to another is depicted by the red arrows.

Key Scenario Components

Reference; LCS Wholeness
CONOPS Rev D

Year: 2016

Forces: 4 LCS (2 / variant)

Forward operating sites: 3

1 Austere capability

1 Moderate capability

1 Robust capability

Seaframe crew rotation: 3:2:1

Key components of the scenario are summarized in the adjacent sidebar. The scenarios included the use of three different Forward Operating Sites (FOS) which geographically mimicked Singapore, Guam and Sasebo. From a capability perspective the three sites were described as being austere (Singapore), moderate (Guam), and robust (Sasebo) with wargame capabilities resembling real-world capabilities for those ports. Table 2-1 outlines the specific maintenance, storage, and transportation capabilities

assumed for each FOS during the wargame. Twenty two different scenario injections were used to create the logistic and sustainment scenario problems. These injections, commonly referred to as Mission Scenario Event List items or MSELs, can be found in Annex A. The players worked through each discrete scenario problem and produced a team solution.

Location Sustainmt Alt	FOS Silver (Singapore) Austere	FOS Green (Guam) Moderate	FOS Salmon (Sasebo) Robust
Turn 1 Baseline	TEAM 1 ★	TEAM 2 ■	TEAM 3 ▲
Turn 2 Baseline/MSELs	TEAM 3 ▲	TEAM 1 ★	TEAM 2 ■
Turn 3 MSELs	TEAM 3 ▲	TEAM 1 ★	TEAM 2 ■
Turn 4 Baseline/MSELs	TEAM 2 ■	TEAM 3 ▲	TEAM 1 ★
Turn 5 MSELs	TEAM 2 ■	TEAM 3 ▲	TEAM 1 ★
Turn 6 MSELs	TEAM 1 ★	TEAM 2 ■	TEAM 3 ▲

Figure 2-1: Wargame Turn-Based Process

An executive panel, a white cell, and an answer cell were used to control and facilitate game play. The executive panel was composed of seven personnel representing USFF, COMPACFLT, COMNAVAIRPAC, PEO-LCS, LCSRON-1, OPNAV N86, and COMNAVSURFPAC. The answer cell was composed of 23 LCS subject matter experts from government and industry and was used to answer player requests for information (RFIs), assess team solutions, and inform the executive panel. The analysis team was part of the white cell and collected data during execution. A modeling and simulation team was available to provide players with insights derived from current LCS maintenance and sustainability models. In total, 18 different organizations participated, identified in Annex A.

2.1. Modified Study Approach

A parallel effort consisting of a comprehensive literature review and SME interviews was conducted while building the sustainment wargame. This effort educated team members about LCS, assisted the game build, uncovered areas for study outside the scope of the game, and initiated the discussion for issue specific intra-game events.

2.2. Subject Matter Expert Breakout Sessions

Three SME breakout sessions were completed during the wargame. The three sessions addressed mission package exchange challenges, near term deployment of LCS, and alternative seaframe rotation cycles. These sessions generated additional data and provided a valuable networking opportunity for participants who previously had been working in parallel but were unaware of the others' efforts.

2.3. Threats to Validity and Reliability of Findings

Threats to validity and reliability were mitigated by the level of expertise of the participants and ongoing research that ran in parallel with game design. Post game follow up interviews with additional SMEs aided in the vetting of and expansion upon issues and recommendations. Each of the seven findings were sent out to SMEs for final review for accuracy, if not concurrence.

Facility	Robust/ Salmon (Sasebo)	Moderate/ Green (Guam)	Austere/ Silver (Singapore)
Piers	Support for 4 LCSs in nested pairs. Two LCS berths available assuming HP USN Ships are in-port.	Support for 4 LCSs in nested pairs in USN-Controlled port	Support for 4 LCSs available at host nation naval base. Berths must be scheduled via USN local representative
Seaframe Maintenance Facility	20 CTR Planning office /140 CTR TDY team/17 Person LCSRON Planning office. 114Kft ² of existing ship maintenance support space Admin office via Leased Trailers. Drydock Capability	20 CTR Planning office /60 CTR TDY team/ 17 Person LCSRON Planning office near LCS Berthing location. Admin office via Leased Trailers	20 CTR Planning office / 17 Person LCSRON Planning office. Temp facility at HN naval base. Repairs conducted by local CTRs done at USN Tenant base ~20miles from LCS Berth locations
MP Maintenance Facility	MMRC 20Kft ² adjacent to SF Maint Facility. 16 person MMRC (1 GOV + 15 CTR TDY Team w/ 13 CTR maintenance techs	MMSA 20Kft ² near SF Maint Facility. 9 person MMRC (1GOV + 8 CTR TDY Team w/ 6 CTR maintenance techs	MMSA 20kf ² near SF Maintenance Facility 2 person MMRC (1 GOV + 1 CTR TDY Team)
AV Maintenance Facility	Helipad at nearby USN complex. Maintenance hangar available local	Available at tenant USN Rotary squadron facility at U.S. base 25miles away	HN airbase 20 miles away-must be prearranged via USN local representative
Transportation	Large Airport 32 miles away Adequate roads and commercial trucking	Large Airport 10 miles away Adequate roads and commercial trucking	Large Airport 2 miles away, HN air base with C-17 capability adjacent to navy base, Adequate roads and commercial trucking
Warehousing	Sufficient warehousing capacity to support mission	Sufficient warehousing capacity but combined with dry stores storage for CLF	No local warehousing but available at USN tenant base 20 miles away
Support Services	Container Handling, Crane services, Shore Power, Full hotel services	Container Handling, Crane services, Shore Power requires temp equipment	Container Handling, Crane services, Full hotel services.
Ordnance Handling/ Storage	Full service ordnance loading and storage, large new storage capacity	Large USN storage facility. Full service T-AKE capable ordnance loading berth	Temporary facility exists at HN Base, arranged by USN rep
FOS Housing	On-Base housing is limited	On-Base housing sufficient	Very limited on-base housing
Commercial Housing	Off-Base housing is available but less desirable	Off-Base housing is limited and largely substandard	Off-Base housing is available but high cost
Local Labor Force	Large – Restricted to non-NOFORN work only	Moderate – skilled in admin/service industry, limited industrial/technical	Moderate – skilled
Cold Storage	10Kft ³ cold storage on base, exchange, commissary, MSC etc.	560f ³ cold storage on base for exchange, commissary and CLF	Very limited - 200f ³ cold storage on US Tennant base 20 miles away

Table 2-1: Forward Operating Site Capabilities

The following three paragraphs speak to matters that could have influenced the accuracy of the findings.

- The timeline from wargame inception to execution was ~75 days between November and late January. This reduced fact finding and research on assumptions prior to the event.
- The results gleaned from a seminar wargame are dependent on SME participation. Repeating the game with different people in attendance could result in different conclusions; but the degree of difference cannot be determined.
- This wargame was a single instance of what could happen; as a result the game has low statistical power and reliability of findings is not assessable. Seminar wargames tend to uncover problems and are not ideal for identifying solutions.

3. Findings

A consolidated list of critical findings is presented in Table 3-1. The findings are listed in priority order as determined in final review by USFF N8 and vetting by wargame stakeholders. These findings are representative of the most critical concerns identified by players at the conclusion of the four day wargame. Additional findings, insights, and supporting data can be found in Annex B.

	Issue Area	Major Finding
1	Mission Package Exchanges	An in-theater LCS Mission Package (MP) exchange requires deliberate planning, coordination, and longer lead time than implied by reference documents.
2	LCS Squadron - Distance Support	The Littoral Combat Ship Squadron (LCSRON) is the critical node for distance support of LCS maintenance, manning, training, and sustainment.
3	Product Support Plan	PSP on-site maintenance highly dependent on workforce skills and capacity able to be delivered to the FOS. Title 10 interpretation restricts labor to U.S. Government and contractors for non-FDNF ships during planned maintenance availabilities.
4	Anti-terrorism/ Force Protection	LCS crews (to include MP personnel) can self-sustain AT/FP measures at FPCON ALPHA for an unlimited period of time. At higher FPCON, AT/FP capability is severely limited without force augmentation or other FPCON mitigations.
5	FOS / ROS Shore Support	LCS FOS sites and potential Remote Operating Sites / port of call require additional port-specific research and planning for shore facilities/equipment requirements and other support capabilities needed for sea-frame, aviation, and mission package sustainment.
6	Ordnance and HAZMAT	Restrictions on ordnance and hazardous materials (HAZMAT) movement / management in Singapore and Japan have potential to impact timely maintenance / logistics and effective operations from selected FOS.
7	Maintenance Strategy	Traditional Planned Maintenance System (PMS) approach is not feasible for forward-deployed LCS due to limitations in ships' force capacity and skills and in capacity ashore at the FOS as compared to INCONUS homeports. Alternative strategy required to include effective utilization/integration of LCs Product Support Plan, Reliability Engineering/Condition-Based Maintenance+ (RE/CBM+) monitoring/forecasting, and establishing effective operations+maintenance battle rhythm.

Table 3-1: List of Major Findings

Explanations of the individual findings follow and are presented in a finding, discussion, and recommendation format. Content of these findings was derived from the data collected during literature review, SME interviews, and data collected at the LCS sustainment wargame.

3.1. Mission Package Exchanges

Finding: In-theater LCS Mission Package (MP) exchange requires deliberate planning, coordination, and longer lead time than implied by reference documents.

Discussion: The complexity of and timelines associated with OCONUS mission package exchanges are underrepresented in reference documents. The LCS Wholeness CONOPS states that mission package exchanges take 96 hours. This number is a Capabilities Development Document (CDD) Key Performance Parameter (KPP) and only represents the hours required to affect the exchange of MP (including mission module (MM) and aircraft) once all of the required people and modules are pier side in theater.

The LCS MP Transportation Logistics CONOPS states that logistical planning and execution may take anywhere from 30 to 60 (or more) days depending on the OCONUS destination¹. This is based both on the time required to arrange and execute transportation (strategic airlift typically 15-30 days and sealift typically 60 days) as well as on the planning, liaising, and permission-seeking required. MP exchange timelines at bases under direct U.S. control will be limited by U.S. airlift or sealift scheduling. Locations where US government control, access, or logistics infrastructure are limited or controlled by another country or organization will be limited by diplomatic permission-seeking and coordination. Additional factors such as country-unique entry and exit requirements for ordnance and HAZMAT may also contribute further delays in completion of MP exchange timelines, as ordnance and HAZMAT are transported separately from MP equipment. These delays are underrepresented in LCS documentation.

To grasp the complexity of this process it is necessary to decompose the mission exchange process into sub-processes associated with each of the disparate pieces of the whole, the mission module, the mission module personnel, the aircraft, the aviation detachment personnel, the mission package exchange team, and the ordnance. See Figure 3-1. The six elements may originate from different places and have unique pre-deployment coordination requirements of varying lengths. Choreographing the preparation and movement of all elements to arrive in theater at the same time is a complex task and subject to potential delays. Notably, one-way movement of an MCM MP requires four C-5 sorties², while one-way movement of an SUW MP requires two C-5 sorties.³ Additional ground transportation must then be arranged to get the MP from the airfield (or port) to LCS pierside. Only when all MP materials and personnel are pierside does the 96 hour KPP for MP exchange apply.

At present, storing MM in CONUS and conducting on demand mission package exchanges OCONUS appears untenable. Storing MM at a FOS were suggested options that would address the time/distance challenges associated with the MMs but would increase manning and infrastructure requirements

¹ Littoral Combat Ship (LCS) Mission Package (MP) Transportation Logistics Concept of Operations. Prepared for Program Executive Office (PEO) Littoral and Mine Warfare/PMS 420. Draft dated 23 Nov 2011. Page 1-7.

² LCS MP Transportation Logistics CONOPS (Draft 23 Nov 2011), Appendix C.

³ LCS MP Transportation Logistics CONOPS (Draft 23 Nov 2011), Appendix D.

forward while doing nothing to ameliorate the aircraft and personnel movement hurdles. Time constraints and the logistical focus of the initial phase precluded the ability to fully explore the following identified issues:

- MP exchange challenges for required pre-deployment training and C2 relationships, such as: who has authority to mandate MP Exchange, how is this communicated, how long to route the order.
- Post-exchange training and certification.
- Off hull package retrograde.

Mission Package Exchange

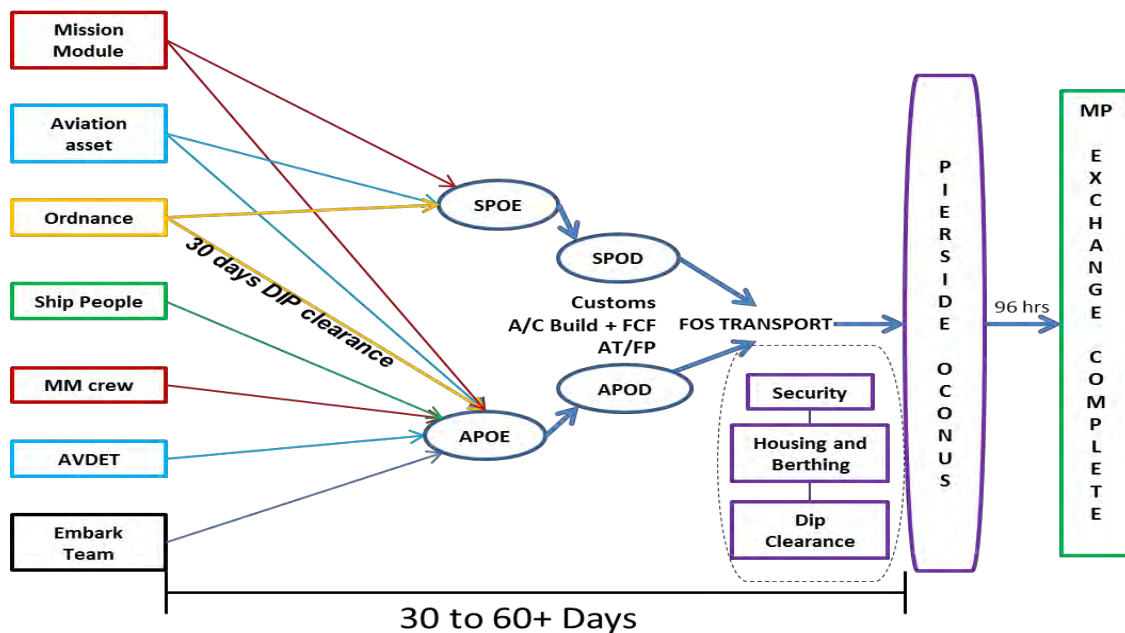


Figure 3-1: Mission Package Exchange Process

A standalone event to evaluate the current MP exchange processes, refine timeline estimates, and explore alternative methodologies will be conducted in-between wargame events.

Recommendations:

1. Update the LCS Platform Wholeness CONOPS with a refined sequence of events of MM, aviation components, crew, ordnance, equipment and supplies, and retrograde. Sequencing will include the C2, transportation, storage/staging, and pier equipment requirements for MM and aviation components of the MP. Submit for final approval.

Lead: PEO LCS / Target Date: OCT 2012

2. Update the LCS Wholeness CONOPS to accurately reflect the in-theater training / certification requirements, logistics timeline, and transportation costs associated with Mission Package Exchanges.

Lead: CNSP / Target Date: OCT 2012

3. Establish mechanism and update directives/documentation to incorporate LCS MM and respective aviation packages (as distinguishable assets separate from LCS sea-frame) into the GFM planning and force allocation decision/approval process.

Lead: USFF N3GFM / Target Date: FEB 2013

4. Establish an effective off-hull mission package upkeep/maintenance, rotation and apportionment plan to support 4 LCS in WESTPAC FOS, focused on Singapore.

Lead: PEO LCS / Target Date: OCT 2012

3.2. LCS Squadron Distance Support

Finding: The Littoral Combat Ship Squadron (LCSRON) is the critical node for distance support of LCS maintenance, manning, training, and sustainment.

Discussion: The LCSRON is a critical node in support of operations, logistics and sustainment of LCS. LCSRON-1 has directives and plans in place to provide this support, but there are organizational issues still to be addressed. The structure, capacity, and functions of the CONUS LCS Support Team (LST), the CONUS Maintenance Support Team (MST), and the OCONUS LCSRON (fwd) are not completely defined.

Alternate mixtures of skills sets and capacity for the seventeen person LCSRON(fwd) detachment, a key support node that remains unfunded beyond 2012, needs review to make the detachment more capable in contingency scenarios where communications with CONUS reachback support may be lost for a prolonged period of time. Command and control roles, responsibilities, and relationships between LCSRON, NFCs, and COCOMs are not codified, and a LCS Continuity of Operations (COOP) plan does not exist.

Recommendations:

1. Develop an LCSRON and shore support system COOP plan to mitigate loss of LCSRON capability, loss of DS communications, and provide for DS data redundancy and maximize connectivity for continued support of squadron ship.

Lead: CNSP w/ LCSRON-1 support / Target Date: Feb 13

2. Continue to refine manning requirement and resource as appropriate LCS Support Team (LST), Maintenance Support Team (MST) and LCSRON FOS Detachment within the FYDP and beyond.

Lead: OPNAV N1 w/ CNSP support / Target Date: Oct 12

3.3. Product Support Plan

Finding: PSP on-site maintenance highly dependent on workforce skills and capacity to be able to deliver to the FOS. Title 10 interpretation restricts labor to U.S. Government and contractors for non-FDNF ships during planned maintenance availabilities.

Discussion: The LCS PSP is still in development and the Maintenance Execution Contract (MEC) in particular will be impacted by the results of some key leadership decisions. There are several as yet

unresolved variables that will have a sizable impact on maintenance team composition, roles, and responsibilities. They are:

- Title 10: Interpretations and clarification of maintenance actions allowable by foreign nationals
- Maintenance Options: PSP is not yet defined and FOS maintenance facilities are not funded
- Fly-Away Teams: Forward-based vs. fly-away maintenance team footprint

U.S.C. § 7310 : US Code Section 7310. Overhaul, repair, etc. of vessels in foreign shipyards: restrictions.

(a) Vessels With Homeport in United States or Guam.— A naval vessel (or any other vessel under the jurisdiction of the Secretary of the Navy) the homeport of which is in the United States or Guam may not be overhauled, repaired, or maintained in a shipyard outside the United States or Guam, other than in the case of voyage repairs.

(b) Vessel Changing Homeports.— (1) In the case of a naval vessel the homeport of which is not in the United States (or a territory of the United States), the Secretary of the Navy may not during the 15-month period preceding the planned reassignment of the vessel to a homeport in the United States (or a territory of the United States) begin any work for the overhaul, repair, or maintenance of the vessel that is scheduled to be for a period of more than six months. (2) In the case of a naval vessel the homeport of which is in the United States (or a territory of the United States), the Secretary of the Navy shall during the 15-month period preceding the planned reassignment of the vessel to a homeport not in the United States (or a territory of the United States) perform in the United States (or a territory of the United States) any work for the overhaul, repair, or maintenance of the vessel that is scheduled— (A) to begin during the 15-month period; and (B) to be for a period of more than six months. (Source: Cornell Legal Information Institute, <http://www.law.cornell.edu/uscode/text/10/7310>)

Figure 3-4: Title 10 US Code, Section 7310

Title 10. Title 10 legal interpretations do not allow foreign nationals to conduct scheduled maintenance evolutions. The definition of “scheduled” includes planned preventative maintenance (PM), corrective maintenance (CM), and facilities maintenance (FM) such as deep cleaning, corrosion control, and painting. If all scheduled maintenance must be done by U.S. citizen maintenance crews, it limits maintenance flexibility, increases cost, and reduces time that LCS platforms will be mission readiness tasking. Flexibility to schedule maintenance evolutions around operations is also limited.

Mitigations such as Title 10 Presidential Waivers require pre-coordination to determine instances when waivers would be requested and how they would be processed. The pace of LCS operations is likely not compatible with the administrative timelines to receive such a waiver unless a waiver of some type is granted for an extended period of time for all LCS work.

It is generally agreed that using fly away teams composed of U.S.-based contractors to perform scheduled work pier side on the ship would be in compliance with the law and that emergent (unplanned) work is not as restrictive and can be done by foreign workers in host nation ship yards. The legal interpretation has yet to be approved for LCS because the specific tasks, man-hours, and scope of foreign worker support, as well as items that U.S. maintenance activities would not be interested in contracting for as fly-away teams (such as the deep cleaning of seaframes), are critical to the legal assessment. The PSP needs to be defined at that level of detail. Then decisions can be made by Senior DON or DOD leadership to notify Congress, seek Title 10 legal decisions, and request Congress to change Title 10, if required. Based on discussions between Pacific Fleet and NAVSEA legal teams regarding plans

for LCS maintenance policy, it is apparent that more discussions will need to occur at this level in order to formulate the PSP.

Maintenance Options. PEO-LCS, LCSRON, and shipbuilders continue to develop models of sea frame maintenance requirements to inform RAV/PMNAV work package planning, especially critical to the high operations tempo expected for LCS in theater. Because the PSP has yet to be defined, the wargame scenario used notional sustainment/maintenance options. Since neither ship has experienced a sustained OPTEMPO and only LCS 1 has had a deployment, the wargame extrapolated LCS 1 and LCS 2 data collected from October 2008 to the present to project a steady-state LCS maintenance requirement in 2016. This resulted in annual estimates of 14,400 hours for PM, 11,200 for CM and 17,000 for FM for a total maintenance load of 42,600 hours. These maintenance hour requirements were then allocated to the various PMNAV and RAV maintenance cycles to provide inputs for the game.

The wargame scenario depicted three different sustainment support options based on current CNAV (aka RAV) activities under the Initial Support Plan (ISP). Although RAV manpower requirements vary, PMS-505 believes 80 to be a typical RAV workforce. PMS-505 has found that having more than 80 people working on the ship at one time becomes inefficient because it is difficult to have several people perform maintenance in the same spaces. PMS-505 postulated a large workforce capable of 2 simultaneous RAVs (160) and made that the robust approach (FOS Salmon). The current average workforce of 80 made up the moderate approach (FOS Green). The austere approach (FOS Silver) is modeled after what was done to support LCS 1 on her initial SOUTHCOM deployment using only fly-away teams. While this approach worked for the initial deployment, it did not involve RAV maintenance. In contrast, the wargame's early deployment breakout session did not consider a sustained rotation but considered the Silver/Austere with a smaller permanent team since it was only supporting one ship. The postulated 2012 flyaway approach has a 50 person team for RAV and 15-20 for PMNAV, and a 5 person permanent team forward. There was no analysis to bridge the 2016 maintenance load (42,000hrs/year) prediction to the LCS 1 deployment in 2013.

During the wargame, the austere option's reliance on fly-away teams from CONUS was a concern due to the recurring travel and per diem costs. The possibility of relief from Title 10 to use host nation personnel for PM, FM, and CM was emphasized as a way to cut these costs. Corrective maintenance (CM) is considered "voyage repairs" for traditional Navy ships and is allowed to be performed by foreign nationals under existing interpretations of Title 10. It was noted that such services are currently provided for in foreign ports; however, the scale of effort for LCS would require process improvements.

Fly-Away Teams. Fly-Away teams have logistical issues associated with travel between countries, such as lead time for Diplomatic Clearance Requests and clearing equipment through customs. During the wargame questions were raised about fly-away team contractors clearing customs with repair parts and what happens to the planned maintenance activity if something goes wrong. These logistical issues have a direct effect on the timeliness of fly-away team support. In addition, a high level of detailed planning is required to ensure effective and efficient use of fly-away teams, which are subject to short-notice maintenance schedule changes as operational requirements shift. Discussion that the austere maintenance option could form the basis of the PSP makes fly-away teams a major issue.

In the wargame scenario, sustainment of four LCS seaframes at the FOS was level-loaded so that there was usually one seaframe in PMAV and one in RAV at the same time. This results in a high maintenance team OPTEMPO. In the wargame's austere maintenance option (FOS Silver), there are no maintenance workers permanently stationed at the FOS. The austere FOS is entirely dependent on fly-away team maintenance support. This generates a recurring requirement to fund transportation and support services (housing and messing) for the fly-away teams. These costs quickly add up due to the high frequency with which fly-away teams were coming in and out to support the LCS seaframes.

The limited repair capability at FOS Silver requires fly-away teams even for limited emergent repairs. There is some risk to depending so heavily on fly-away teams due to the potential for schedule conflicts; loss of equipment and/or parts; delay of either the parts or the expertise required for a PMAV/RAV which would introduce delays and impact the overall maintenance schedule. This could have a big impact on the ships force while awaiting the fly-away team, possibly pushing more maintenance onto the ships force as people or parts are delayed en route. Additionally, this could negatively impact the crew's ability to maintain the required AT/FP posture. Emergent corrective and/or additional maintenance/repair requirements will increase lead times required for coordination and delay repairs, especially any requirements for specialized skills such as divers.

Players concluded that robust pre-planning is required for the use of fly-away teams at any FOS. There needs to be extensive coordination with the LST to get necessary services if no husbanding agent representative is on site. Other considerations for fly-away team repairs are host nation customs requirements, the availability of limited strategic airlift capacity for repair parts and equipment, regulations, and coordination for the movement of HAZMAT into the host nation. Coordinating customs, diplomatic, and HAZMAT clearance lead times could be difficult given the volume of personnel, parts and equipment required to flow through the APOD at an austere FOS.

A business case analysis is needed to identify the costs of fly-away teams compared to the costs of PCS for a "moderate FOS" maintenance team able to meet the same maintenance OPTEMPO. Players speculated whether a hybrid approach would be more efficient, with some personnel PCS to the FOS as a core maintenance crew (but fewer than in the moderate FOS approach), with additional fly-away team support (flown in from CONUS or Japan) pushed forward as needed at lesser fly-away OPTEMPO than would be required for the austere FOS option. In addition, players speculated that the fly-away team approach could be made more efficient if maintenance for seaframes was overlapping instead of level-loaded. A business case analysis would help answer these questions and allow leadership codify a maintenance strategy and define PSP requirements.

Recommendations:

1. Define Title 10 guidelines for periodic scheduled maintenance of a non-FDNF ship.

LEAD: NAVSEA / Target Date Jul 12

2. Seek waiver of Title 10 restrictions, if necessary, to optimize use of host nation personnel for preventive and facilities maintenance.

LEAD: NAVSEA / Target Date Oct 12

3. Conduct business case analysis to assess cost and effectiveness of maintenance strategies involving Gov't/Contractor hybrids of PCS, Fly-away, and HN maintenance teams.

LEAD: PEO LCS/ PMS 505 / Target Date Feb 13

3.4. Anti-Terrorism/Force Protection (AT/FP)

Finding: LCS crews (to include MP personnel) can self-sustain AT/FP measures at FPCON ALPHA for an unlimited period of time. At higher FPCON, AT/FP capability is severely limited without force augmentation or other FPCON mitigations.

Discussion: The Wholeness CONOPS states that LCS can meet AT/FP requirements without augmentation or mitigation up to FPCON BRAVO. This is not accurate. At non-US navy bases LCS requires a mission module (MM) crew embarked to sustain FPCON ALPHA requirements. Without a MM crew embarked, pier watch requirements must be fulfilled by outside agencies (i.e., Maritime Expeditionary Security Force (MESF), Contract, local law enforcement, etc.) due to lack of manpower. Even with MM crew embarked, LCS lacks adequate manpower to maintain FPCON BRAVO for more than 24-hours. Daily AT/FP watchstations consume half the crew, impacting crew rest and the ability to conduct routine maintenance. See Figure 3-2.

LCS Duty Section Manning with AT/FP

	Total Watch Requirements (per duty day)	% Core Crew on watch	% Core Crew w/ MM
Non-Navy Controlled Ports			
ALPHA	36+	>90%	>65%
BRAVO	41+	>102%	>74%
CHARLIE/ DELTA	56+	>140%	>101%
Navy Controlled Ports			
ALPHA	31+	>77%	>56%
BRAVO	36+	>90%	>65%
CHARLIE/ DELTA	56+	>140%	>101%
Notes:			
1. Numbers include CDO			
2. (+) RAMs Directed or Self-Imposed			
3. Assumes core crew of 40			
4. Assumes MM adds 15 personnel to crew. AVDET does not support AT/FP watches.			
5. Numbers are notional. AT/FP watch requirements vary considerably from port to port and numbered fleet to numbered fleet as well as based on situation			

Figure 3-2 AT/FP Manning Requirements

AT/FP requirements pose a problem for the LCS even in CONUS. For example, a LCS core crew had to be augmented by forty eight Navy personnel and a contract harbor security boat in a recent port visit to St. Petersburg, Florida in order to meet CONUS AT/FP requirements. Strain caused by AT/FP manning requirements is likely to become more pronounced during port visits that require participation in COMREL projects as part of Theater Security Cooperation (TSC) tasking or receptions for local DVs.

When in port for PMAV / CMAV periods, further increases in manpower would be needed to monitor maintenance work, escort foreign national ship workers, and coordinate services. LCS sailors will have little time for shore leave while in port unless adequate AT/FP augmentation is provided. LCSRON staff reports that AT/FP FPCON measures have been waived every time LCS-1 or LCS-2 has pulled into port. These mitigations have been approved each time. This indicates a potential for blanket LCS AT/FP manning related mitigations to be adopted into Navy wide AT/FP directives and OPORDS.

Recommendations:

1. Review and update, as required, the following documents, to account for LCS FPCON limitations:

- a. Navy Wide Arming Matrix
- b. FPCON measures delineated in DoDI 200.16 to address applicability to LCS manning constraint
- c. Manpower mitigations in the Navy Wide OPTASK AT/FP targeted for release 31MAY2012

Lead: USFF N3AT / Target Date: Dec 2012 / USFF AFTP Requirements Working Group - 01 Mar

2. Review status of and prioritize for update (or new start) Personal Security Vulnerabilities Assessments (PSVA) on all potential WESTPAC ports of call for LCS. Identify ports LCS will visit that have never or very infrequently been visited by USN Ships. Coordinate site surveys, husbanding contracts, and points of contact with port and HN government personnel, as appropriate.

Lead: CPF / Target Date: OCT 2012

Ship Drafts

FFG -7 22 ft

DDG-51 27.6 ft

LCS -1 14 ft

3.5. FOS/ROS Shore Support for LCS

Finding: LCS FOS sites and potential Remote Operating Sites (ROS) / port of call require additional port-specific research and planning for shore facilities/equipment requirements and other support capabilities needed for sea-frame, aviation, and mission package sustainment. Beyond the FOS, LCS subsistence and fuel replenishment will rely heavily on brief stops in port.

Discussion: LCS has a number of unique logistical constraints compared to other ships, to include smaller fuel capacity and potentially very high fuel consumption, regular crew rotations, and regular monthly and quarterly maintenance periods which require extensive off-ship support.

Forward Operating Sites. Upgrades must be made to fully prepare each FOS to accept LCS seaframes and support staff. Assessment of and improvement to existing infrastructure, new construction for workspace, warehousing, billeting and messing, conduct of environmental impact studies, establishment of ordnance and HAZMAT handling, clearance, movement, storage, and disposal procedures, and contracting for FOS transportation and overflow billeting must all be completed prior to basing LCS in the proposed forward operating sites. Of these requirements the identification, planning, and budgeting of new construction are the most urgent. The host nation for the first FOS (Singapore) has agreed to build the required infrastructure. Accurate requirements must be provided to the host nation so they can be properly budgeted and built in time for sustained presence. Military construction

(MILCON) for other potential forward operating sites (Guam and Sasebo) to support LCS operations in 2016 and beyond has not been budgeted. Given that the typical MILCON lag time is 2 years, Program Objective Memorandum 2014 (POM-14) is the deadline for funding construction in 2016 at other FOS sites.

Shallow Draft Ports. One of the advantages of LCS is its shallow draft. This implies LCS may operate from and visit ports not currently used by the US Navy. These new ports will have to be identified and prioritized in advance, so that limited resources to conduct site surveys and Personal Security Vulnerabilities Assessments (PSVA) can be allocated to determine capabilities and limitations for supporting LCS.

Digital Nautical Charts (DNC). LCS is not configured to use paper charts and, at present, Electronic Chart and Display System-Navy (ECDIS-N) is only certified to use DNC for navigation. OPNAV, CPF and USFF are working on modification and certification of ECDIS-N to use Electronic Navigation Charts (ENC) beginning with ENC of the US produced by NOAA. Until ECDIS-N is certified to use the Electronic Navigation Chart (ENC), DNC is the only option for support to LCS. Therefore, Voyage Management System compatible Digital Nautical Charts (DNC) are required for all ports in the AOR where LCS is expected to operate. Ports for which DNCs do not exist will be unusable for LCS (and not all countries will produce ENC). Other ships rely on paper charts as a backup when DNC is not available or as the primary navigation tool in the event a particular port does not have DNC coverage, but this is not an option for LCS. Ports where LCS is expected to operate must be identified and prioritized early in order to ensure DNC are available, as the National Geospatial-Intelligence Agency (NGA) has limited resources to develop new DNCs.

Subsistence Replenishment. LCS is unable to conduct connected underway replenishment (CONREP) for passing stores. This leaves vertical underway replenishment (VERTREP) or small boat transfer as the only options for subsistence replenishment while underway. LCS seaframes hold approximately 14 days of subsistence onboard which is 5-6 days less than a Frigate's storage capacity. Although this suggests frequent replenishment will be necessary, operational experience to date has shown that actual subsistence endurance exceeds 14 days and depends on the number of people onboard and food management.

- VERTREP: In C7F, only 3 of 10 combat logistics force (CLF) assets have helicopters. Therefore the LCS platforms will have to use their single embarked MH-60 to transfer freight and stores during most replenishment at sea events. Both MH-60 variants can support VERTREP, but the MH-60R will not be ASW capable for a period of time before and after the replenishment at sea, as time is needed to remove and reinstall ASW equipment.
- Small Boat Transfer: While stores and freight could be moved by small boat to avoid use of a helicopter it would be a very slow process. Replenishment by small boat would put the burden on the provisioning ship to provide the boat because LCS does not carry boats appropriate for this purpose.

Refueling. The LCS platform's smaller fuel capacity and potential for much higher fuel burn rates at full power mean it will need to be refueled more frequently than traditional CRUDES platforms. The LCS will have three primary refueling options: (1) CLF refueling at sea; (2) brief stops for fuel in port; (3) refueling

events with L-decks and carriers when the LCS is operating with an ESG or CSG. The preferred fuel for operating seaframe engines is diesel fuel marine (DFM). This makes L-ships the preferred option for bunkering at sea, due to their DFM capacity.

Given the low density of CLF assets in the Pacific Ocean, brief stops for fuel will be used frequently by LCS throughout the AOR. The current C7F in port Defense Logistics Agency (DLA) and Husbanding Service Provider (HSP) fuel contracts must be reviewed to support LCS emergent/contingency refueling requirements. Current DLA Energy SEACARD contracts have high minimum fuel order levels and require a minimum 48 hours notice, while HSP contracts require 5-10 days notice and DLA SEACARD Open Market Contracts require 10-15 days notice. If operating at speeds above 30 knots, the LCS could require refueling as frequently as every 24 hours, making these minimum notice times unacceptable in a contingency situation.

As a follow-on event, NWDC will convene a LCS near term deployment working group for Fleet, LCS, and COCOM planners, and logisticians to determine near term risks to mission success and develop mitigations. The output will drive planning for the 2013 LCS deployment and inform the June 2012 LCS Wargame.

Recommendations:

1. Identify and prioritize infrastructure requirements for likely LCS of ports of call in PACFLT AO.
Lead: CPF / Target Date DEC 2012
2. Establish FOS shore infrastructure requirements. Engage Singapore (HN) with prioritization of LCS support requirements and possible cost sharing arrangements. Identify and resource gaps and seams not supported by HN.
Lead: CPF w/CNIC support (Requirements), OPNAV N4 (Resourcing), OPNAV N3/5 (HN agreements) / Target date: Jun 2012
3. Submit to the National Geospatial-Intelligence Agency (NGA) a prioritized list of DNC production requirements for ports in the PACFLT AO that will be used by LCS.
LEAD: CPF w/ OPNAV N2/6 support / Target Date ECD: Oct 12

3.6. Ordnance and Hazardous Materials

Finding: Restrictions on ordnance and hazardous materials (HAZMAT) movement / management in Singapore and Japan have potential to impact timely maintenance / logistics and effective operations from a selected FOS.

Discussion: LCS capacity for ordnance and HAZMAT is limited. When a mission package is exchanged, there is typically no room to keep ordnance or HAZMAT other than what is required for the new mission module and AVDET. Policies, procedures, and facilities for transport, retrograde, and/or storage of ordnance and HAZMAT materials should be reviewed with a view toward specific requirements to support LCS operations at forward operating stations. Host nation restrictions and requirements require further analysis and development of plans to support receipt, transportation, and potential

loading/retrograde options with consideration of the unique sensitivities at each FOS. This planning will also be important in negotiating changes to existing host nation agreements, if required.

HAZMAT. A plan is needed to provide and manage the HAZMAT for maintenance, ship support, AVDET support, and mission module exchanges. Maintenance includes volume items such as lubrication oil and hydraulic fluid. When a mission module is exchanged HAZMAT requirements may involve the need to use additional transportation assets. Establishing procedures to review required HAZMAT and see what is available in theater could minimize these transportation costs. To date, the Navy provides all on board HAZMAT storage and supply support for seaframe, MM and AVDET, but this will not be effective at new FOS sites without prior coordination. The Navy will need to scope storage volume and compatibility requirements and leverage existing NAVSUP GLS capacity for HAZMAT support at the FOSs. This issue is time-critical in support of the 2013 LCS deployment. Additionally, the Navy will need to understand the HAZMAT support plan, especially reuse and storage requirements for the early deployment.

Ordnance. There are three concerns with LCS ordnance. First, the transport of ordnance to and from overseas sites in order to load or retrograde ordnance for mission packages exchanges requires dealing with diplomatic and procedural issues. Second, stockpiles of some LCS-specific ordnance are limited because they are relatively new to US inventory. Third, there is the need to incorporate LCS ammunition requirements in load plans of forward magazines.

- **Transport:** Some host countries have ordnance movement restrictions. It can be extremely challenging to move ordnance and weapons systems through these countries even with pre-negotiated host nation agreements. Furthermore, movement of ammunition has to be done at a facility with a DoD Explosives Safety Board (DDESB) site approval. Movement of ammunition at commercial airfields is generally not permitted. While some ordnance can be held for on load or offload at sea, some mission package components cannot be loaded at sea but must be done in port with pier crane support. With the exception of missiles, MM-related ammunition generally can be moved underway. Further analysis to identify receipt, transportation, and potential loading/retrograde options in each FOS is required.
- **Stockpiles:** There are some concerns about Airborne Mine Neutralization System (AMNS) mine neutralizers, 57mm, and 30mm ammunition as being relatively new to U.S. inventory. The U.S. has not built up a large stockpile to enable wide distribution to forward magazines. Specific numbers/locations of available ordnance are classified, but ability to meet total munitions requirements (TMR) is a legitimate concern for some types of ammunition.
- **Load Plans:** If LCS ordnance load requirements are not part of the FOS ordnance facility load-plan there could be as much as a 30 day delay moving material while waiting for diplomatic clearance. In general, LCS load requirements need to be rolled into the ammo facility Global Requirements Based Load Plan (GRBLP) when possible. For all LCS mission package ammunition, efforts are needed to ensure they are incorporated into the load plans at forward locations. This ensures there is a documented Fleet demand signal to ensure the load plans at various sites will support LCS where magazine space is available and that overall munitions procurement is adequate. For example, Guam may have available magazine space but no load plan for LCS mission package ammunition. FOS load plans need to be modified to reflect LCS requirements. Once these LCS support load plans

are settled, material will flow as allocated/prioritized by OPNAV and the Fleet commanders based on availability.

Recommendations:

1. Identify likely ports LCS will use for mission package exchanges and negotiate agreements to support ordnance and HAZMAT management.

Lead: CNSP / Target Date: Mar 13

2. Create an LCS Ordnance Transportation Logistics CONOPS to address the process, sequencing, transportation, onload / offload of ordnance aboard LCS seaframe in CONUS and OCONUS.

Lead: PEO LCS / Target Date: Mar 13

3. Develop a LCS HAZMAT management instruction to support seaframe and mission package maintenance, HAZMAT storage, offload, on load, and transportation requirements to support the FOS.

Lead: NAVSUP / Target Date: Jan 13

3.7. Reliability Engineering/Condition-Based Maintenance* (RE/CBM*)

Finding: Traditional Planned Maintenance System (PMS) approach is not feasible for forward-deployed LCS due to limitations in ships' force capacity and skills and in capacity ashore at the FOS as compared to INCONUS homeports. Alternative strategy required to include effective utilization/integration of LCs Product Support Plan, Reliability Engineering/Condition-Based Maintenance+ (RE/CBM+) monitoring/forecasting, and establishing effective operations+maintenance battle rhythm.

Discussion: On traditionally manned Navy ships, PMS is performed entirely by the ship's crew. Due to maintenance man hours available within the LCS crew, PMS maintenance efforts are divided between Sailors and contracted maintenance providers. To date, approximately one third of the contracted maintenance support cost for USS FREEDOM (LCS 1) is attributable to PMS efforts.

The traditional Planned Maintenance System (PMS) strategy levies a heavy strain on core seaframe and mission module crews to complete scheduled PMS. Shifting to a Reliability Engineering/Condition Based Maintenance (RE/CBM) system could better maximize efficient and effective LCS class sustainment.

The current LCS PMS deck reflects an approach consistent with traditional PMS efforts developed on a time based system. Inspection periodicity is derived from equipment performance and historical data. Inspections are performed by rote with no consideration taken for differences in operating conditions, mission workload, and the like. This traditional approach is a time proven method of executing PMS, but implementing it on a minimally manned platform like LCS overtaxes the crew with unnecessary, redundant inspections that could safely be omitted from the PMS deck if the RE/CBM+ strategy was adopted. RE/CBM+ is an approach using real time data to make predictions based on key equipment parameters that allows for maintenance actions to occur only when key equipment parameters indicate a maintenance action is required or approaching a degraded status.

If RE/CBM+ is implemented in key systems onboard LCS seaframes, a significant reduction of PMS man hours could be realized. This strategy is made possible by the nearly 7,000 sensors already installed onboard LCS class ships that support automation and reduced watch standers. Many of these sensors support near real time data analysis and predictive calculations to determine the condition of ships' equipment. With the addition of as few as 200 more sensors to meet specific engineering needs, maximized RE/CBM+ benefit and minimized crew PMS responsibilities could be realized.

A RE/CBM+ approach to PMS has already been adopted for LCS 1 ship service diesel generators (SSDGs). This approach has reduced PMS workload by 40% for both contractors and crew. In addition, a total of 40,000 man hours of maintenance has been eliminated for the operating life of each of the SSDGs. Similar reductions could be achieved with other systems if this strategy was adopted for all LCS.

Crew PMS efforts onboard FREEDOM average between 40-50% of the overall monthly PMS effort. By installing RE/CBM+ related sensors where needed, installing RE/CBM+ related software, and re-writing the PMS deck to reflect RE/CBM+ metrics, elimination of contracted PMS efforts entirely is possible. This approach would improve operational persistence while reducing cost of contracted maintenance fly away teams. The current maintenance strategy for LCS requires at least 5 days in port for every 25 days underway to allow for contractor PMS support. Returning all PMS efforts to the crew could eliminate the need for a monthly 5 day PMS in port period and therefore would increase unit flexibility to remain underway when needed. Eliminating or drastically reducing contractor PMS efforts reduces the oversight and coordination required to support a large number of contractors in FOSs in regular intervals. Rather than allowing PMS to force a more frequent interval for in port maintenance, emergent maintenance would drive in port maintenance periods as often does in our current fleet.

Recommendations:

1. Evaluate Reliability Engineering Model for potential elimination and /or reduction in preventive maintenance requirements, to include "replace when fail" approach as appropriate.
LEAD: PEO LCS / Target Date: Oct 12
2. Conduct bottom-up review of PMS deck for LCS 1 and provide recommendations on adjustments, based on RE approach.
LEAD: PEO LCS / Target Date Oct 12
3. Conduct CBA of sensors/software installation plan aboard LCS 1 to determine potential LCS program-wide manhours and cost savings. Implement POAM for LCS-Class RE installation as appropriate.
LEAD: PEO LCS / Target Date Dec 12

4. Conclusions

The LCS Program is a groundbreaking effort to develop and operate a unique ship, or "seaframe" with unique operational and sustainment concepts involving interchangeable mission modules. As cited in the LCS Platform Wholeness CONOPS (sect 1.7), "The ship's unique design features, its rapid and unconventional acquisition strategy, and groundbreaking operational and sustainment concepts have

combined to pose significant challenges since the program's inception.” The LCS Wargame brings to the fore once again that these operational and sustainment concepts challenge the status quo.

The Littoral Combat Ship is not a single entity but a unique combination of eleven entities, each with its own unique set of manning, training, equipping, logistics, and sustainment issues that need to be explored and addressed individually. The sub-entities are displayed in Figure 4.1. Additionally, there is a sizable body of issues that emerge once the parts are brought together. It is a complex system. Complex systems diverge easily; that is their nature. The identified risks, the issues associated with the findings, and some of the recommendations are complicated. The Navy must ensure actions are taken to address any risks of divergence among the sub-entities that make up the LCS capability.

The identified findings and risks provide a consolidation of both perspective and information that can be used to increase understanding of planning factors associated with sustainment and logistic support of LCS seaframes and mission packages. More detailed information is contained in Annex B.

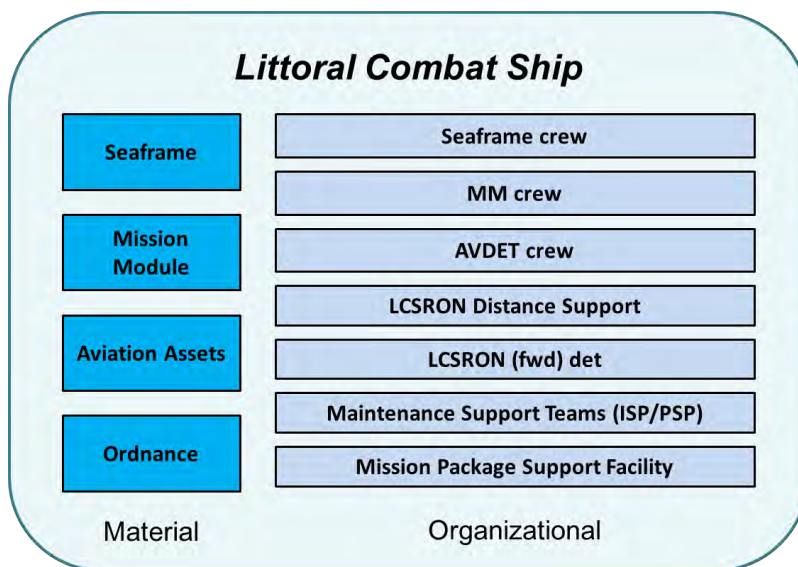


Figure 4.1 Littoral Combat Ship Sub-Entities

The recommendations produce a plan of action and milestones to mitigate the risks, advance LCS sustainment capabilities, and prepare for future Pacific Fleet AOR operations.

5. Way Ahead

Phase I identified logistics and sustainment challenges and gaps. Phase II will be operationally focused and will provide CUSFFC/CPF/NCCs a comprehensive understanding of the capabilities and limitations for the Littoral Combat Ship (LCS) sea frames and associated Mission Packages, in order to establish a framework for effectively planning and executing LCS operational employment of focused missions. An initial draft list of sub-objectives are as follows:

- 1) Examine LCS mutual and self-defense capabilities operating independently, when in associated or direct support of a Strike Group, or as part of a Surface Action Group

- 2) Examine tactical employment of LCS operating independently, when in associated or direct support of a Strike Group, or as part of a Surface Action Group.
- 3) Examine the operational flexibility of LCS to change capacity and capability (pre-sail) versus the in-theater tactical flexibility of LCS to reconfigure (e.g., MP exchanges.) and the associated decision processes.
- 4) Examine LCS operational C2 concepts when operating independently, when in associated or in direct support of a Strike Group, or as part of a SAG.
- 5) Determine the flexibility of a deployed LCS with a designated MP for operational commander employment in HA/DR, NEO and TSC missions.

While Wargame Phase I focused almost exclusively on logistics and sustainment issues, these important enablers to operational and mission success will continue to be considered in Wargame Phase II. Modeling and simulation of operational data and concepts will be used where appropriate to more fully develop the Fleet's understanding of issues and solutions to operational challenges for LCS operating from a WESTPAC FOS site. As in Phase I, the objective of Phase II will be to deliver clear recommendations to resolve identified problems with well-defined actions and accountable organizations.

Phase II proceeds forward with

- **07-08 MAR** ***Phase II Initial Planning Conference***
- **12 MAR(t)** ***Phase II Objectives / Venues Options brief to CUSFFC***
- **03-04 APR** ***Phase II Mid Planning Conference***
- **08-09 MAY** ***Phase II Final Planning Conference***
- **11-15 JUN** ***Phase II Execution***
- **15 AUG** ***Final LCS Wargame Report***

In preparation for Phase II, research excursions will be conducted by NWDC to clarify Fleet commanders' intent for LCS, the MP exchange process beyond the 96 hours specified in the CONOPS, the upcoming LCS early deployment, and seaframe rotation variations from the currently planned 16-month cycle.